CANOPY STRUCTURE IN THE 'ŌHI'A DECLINE ZONE OF MAUNA KEA AND MAUNA LOA, HAWAI'I*

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The 'ōhi'a (Metrosideros collina subsp. polymorpha) and koa (Acacia koa) canopies of 40 stands within the 'ōhi'a decline zone were studied. Variables examined included stand density and basal area of dominants, ratio of declining to healthy basal area of 'ōhi'a, density of 'ōhi'a reproduction, and diameters of declining and healthy 'ōhi'a. Seven canopy types were distinguished using group and centroid averaging agglomerative clustering algorithms and principal components and analyses.

In order of decreasing wetness of the site, the six declining canopy types are: (1) bogs without topograpic relief; (2) bogs with topographic relief and stands dominated by uluhe (Dicranopteris spp.); (3) swamp forest stands characterized by a more equitable distribution of moderately well drained and poorly drained substrate; (4) low elevation (600-1000 m) stands on Mauna Kea characterized by abundant koa; (5) stands on Mauna Loa characterized by a continuous tree fern (Cibotium spp.) canopy; (6) mid- to high elevation (1200-1400 m) stands on Mauna Loa characterized by abundant pubescent 'ōhi'a. Within the healthy canopy type, occurring only on well to moderately well drained substrates, I recognized dense, closed, and open phases.

Regeneration of 'ōhi'a is abundant in the swamp forest type. Regeneration is less abundant in the pubescent 'ōhi'a and continuous tree fern canopy types and very little regeneration occurs in any other decline or healthy canopy type.

The structural data indicate a successional trend towards open 'ōhi'a forest with a continuous tree fern canopy in the absence of disturbance on moderately well to well drained ash or lava substrates at low to mid-elevations on Mauna Loa.

All stands dominated by pubescent 'ōhi'a (healthy or declining) occur on extremely shallow and presumably young histosols over lava at mid- to high elevations on Mauna Loa.

While closed 'ōhi'a canopy is still found on Mauna Kea, no stands with even moderately abundant 'ōhi'a regeneration were sampled. Successional trends seem to be towards bogs on wet sites. On moderately well drained sites without closed 'ōhi'a canopy, tree fern species do not form closed canopies. Disturbance, especially by feral pigs, and nutrient leaching may be important factors determining successional trends on these sites.

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* Abstract